

## § 23.1461

a manner that they are not likely to be separated during crash impact.

(e) Any novel or unique design or operational characteristics of the aircraft shall be evaluated to determine if any dedicated parameters must be recorded on flight recorders in addition to or in place of existing requirements.

[Amdt. 23-35, 53 FR 26143, July 11, 1988]

### § 23.1461 Equipment containing high energy rotors.

(a) Equipment, such as Auxiliary Power Units (APU) and constant speed drive units, containing high energy rotors must meet paragraphs (b), (c), or (d) of this section.

(b) High energy rotors contained in equipment must be able to withstand damage caused by malfunctions, vibration, abnormal speeds, and abnormal temperatures. In addition—

(1) Auxiliary rotor cases must be able to contain damage caused by the failure of high energy rotor blades; and

(2) Equipment control devices, systems, and instrumentation must reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It must be shown by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors must be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

[Amdt. 23-20, 42 FR 36969, July 18, 1977, as amended by Amdt. 23-49, 61 FR 5170, Feb. 9, 1996]

## Subpart G—Operating Limitations and Information

### § 23.1501 General.

(a) Each operating limitation specified in §§ 23.1505 through 23.1527 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to

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the crewmembers as prescribed in §§ 23.1541 through 23.1589.

[Amdt. 23-21, 43 FR 2319, Jan. 16, 1978]

### § 23.1505 Airspeed limitations.

(a) The never-exceed speed  $V_{NE}$  must be established so that it is—

(1) Not less than 0.9 times the minimum value of  $V_D$  allowed under § 23.335; and

(2) Not more than the lesser of—

(i) 0.9  $V_D$  established under § 23.335; or

(ii) 0.9 times the maximum speed shown under § 23.251.

(b) The maximum structural cruising speed  $V_{NO}$  must be established so that it is—

(1) Not less than the minimum value of  $V_C$  allowed under § 23.335; and

(2) Not more than the lesser of—

(i)  $V_C$  established under § 23.335; or

(ii) 0.89  $V_{NE}$  established under paragraph (a) of this section.

(c) Paragraphs (a) and (b) of this section do not apply to turbine airplanes or to airplanes for which a design diving speed  $V_D/M_D$  is established under § 23.335(b)(4). For those airplanes, a maximum operating limit speed ( $V_{MO}/M_{MO}$ -airspeed or Mach number, whichever is critical at a particular altitude) must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training operations.  $V_{MO}/M_{MO}$  must be established so that it is not greater than the design cruising speed  $V_C/M_C$  and so that it is sufficiently below  $V_D/M_D$  and the maximum speed shown under § 23.251 to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between  $V_{MO}/M_{MO}$  and  $V_D/M_D$  or the maximum speed shown under § 23.251 may not be less than the speed margin established between  $V_C/M_C$  and  $V_D/M_D$  under § 23.335(b), or the speed margin found necessary in the flight test conducted under § 23.253.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-7, 34 FR 13096, Aug. 13, 1969]

### § 23.1507 Operating maneuvering speed.

The maximum operating maneuvering speed,  $V_O$ , must be established

as an operating limitation.  $V_O$  is a selected speed that is not greater than  $V_S\sqrt{n}$  established in § 23.335(c).

[Doc. No. 26269, 58 FR 42165, Aug. 6, 1993]

#### § 23.1511 Flap extended speed.

(a) The flap extended speed  $V_{FE}$  must be established so that it is—

(1) Not less than the minimum value of  $V_F$  allowed in § 23.345(b); and

(2) Not more than  $V_F$  established under § 23.345(a), (c), and (d).

(b) Additional combinations of flap setting, airspeed, and engine power may be established if the structure has been proven for the corresponding design conditions.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23-50, 61 FR 5192, Feb. 9, 1996]

#### § 23.1513 Minimum control speed.

The minimum control speed  $V_{MC}$ , determined under § 23.149, must be established as an operating limitation.

#### § 23.1519 Weight and center of gravity.

The weight and center of gravity limitations determined under § 23.23 must be established as operating limitations.

#### § 23.1521 Powerplant limitations.

(a) *General.* The powerplant limitations prescribed in this section must be established so that they do not exceed the corresponding limits for which the engines or propellers are type certificated. In addition, other powerplant limitations used in determining compliance with this part must be established.

(b) *Takeoff operation.* The powerplant takeoff operation must be limited by—

(1) The maximum rotational speed (rpm);

(2) The maximum allowable manifold pressure (for reciprocating engines);

(3) The maximum allowable gas temperature (for turbine engines);

(4) The time limit for the use of the power or thrust corresponding to the limitations established in paragraphs (b)(1) through (3) of this section; and

(5) The maximum allowable cylinder head (as applicable), liquid coolant and oil temperatures.

(c) *Continuous operation.* The continuous operation must be limited by—

(1) The maximum rotational speed;

(2) The maximum allowable manifold pressure (for reciprocating engines);

(3) The maximum allowable gas temperature (for turbine engines); and

(4) The maximum allowable cylinder head, oil, and liquid coolant temperatures.

(d) *Fuel grade or designation.* The minimum fuel grade (for reciprocating engines), or fuel designation (for turbine engines), must be established so that it is not less than that required for the operation of the engines within the limitations in paragraphs (b) and (c) of this section.

(e) *Ambient temperature.* For all airplanes except reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, ambient temperature limitations (including limitations for winterization installations if applicable) must be established as the maximum ambient atmospheric temperature at which compliance with the cooling provisions of §§ 23.1041 through 23.1047 is shown.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23-21, 43 FR 2319, Jan. 16, 1978; Amdt. 23-45, 58 FR 42165, Aug. 6, 1993; Amdt. 23-50, 61 FR 5192, Feb. 9, 1996]

#### § 23.1522 Auxiliary power unit limitations.

If an auxiliary power unit is installed, the limitations established for the auxiliary power must be specified in the operating limitations for the airplane.

[Doc. No. 26269, 58 FR 42166, Aug. 6, 1993]

#### § 23.1523 Minimum flight crew.

The minimum flight crew must be established so that it is sufficient for safe operation considering—

(a) The workload on individual crewmembers and, in addition for commuter category airplanes, each crewmember workload determination must consider the following:

(1) Flight path control,

(2) Collision avoidance,

(3) Navigation,

(4) Communications,

(5) Operation and monitoring of all essential airplane systems,

(6) Command decisions, and